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DILLON RESERVOIR, MUSKINGUM COUNTY, OHIO

PACIFIC NORTHWEST ENVIRONMENTAL
RESEARCH LABORATORY

PREPARED FOR
NATIONAL ENVIRONMENTAL RESEARCH CENTER

JUNE 1975

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PB 254 910

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
DILLON RESERVOIR
MUSKINGUM COUNTY
OHIO
EPA REGION V
WORKING PAPER No. 400

WITH THE COOPERATION OF THE
OHIO ENVIRONMENTAL PROTECTION AGENCY
AND THE
OHIO NATIONAL GUARD
JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Ohio Environmental Protection Agency for professional involvement, to the Ohio National Guard for conducting the tributary sampling phase of the Survey, and to those Ohio wastewater treatment plant operators who provided effluent samples and flow data.

Ned Williams, Director, and Tom Birch, Ken Carr, Larry Dietrick, Ron Havlice, Larry Korecko, Rod Mehlhop, Terry Wheeler, and John Youger, Ohio Environmental Protection Agency, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

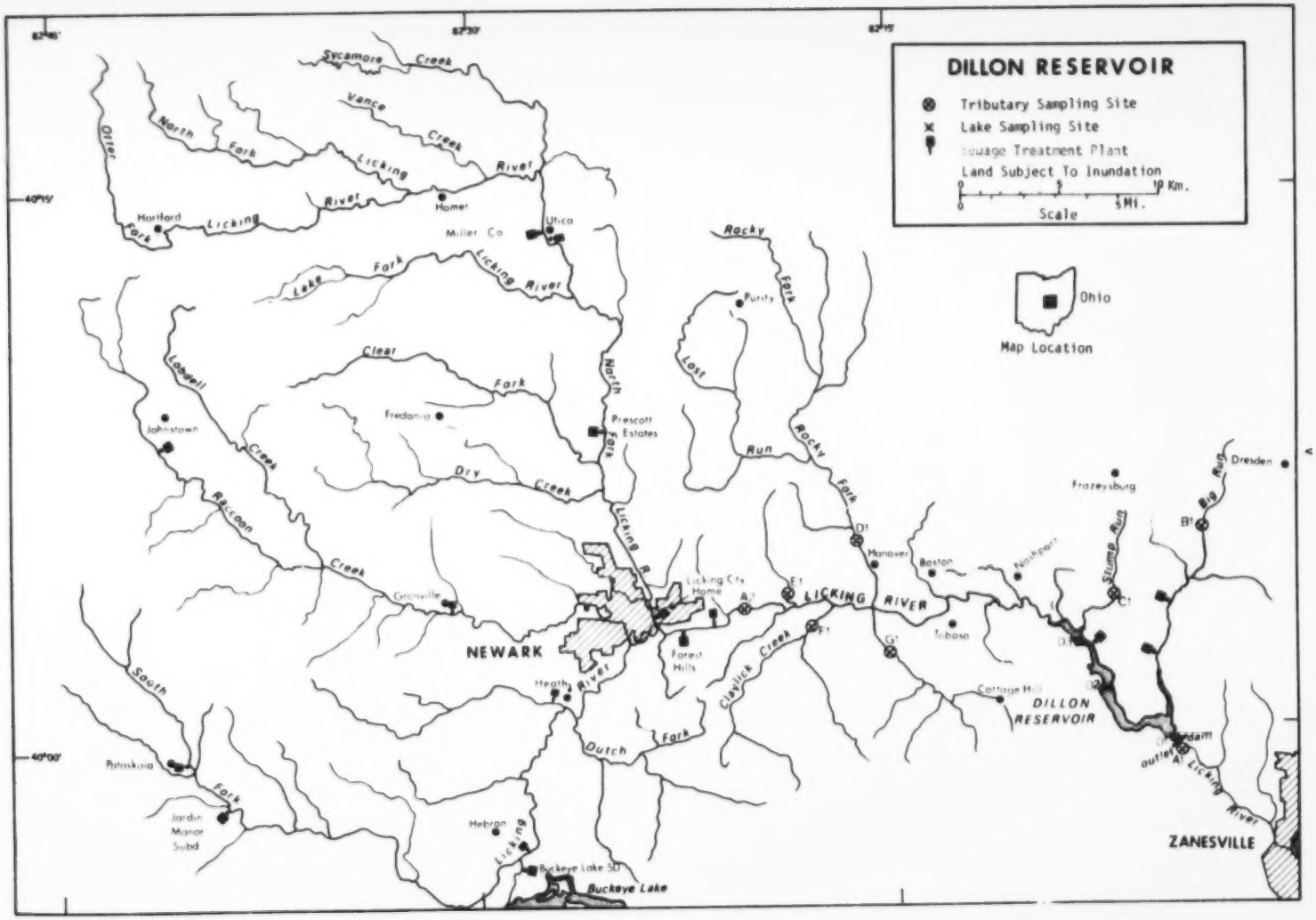
Major General Dana L. Stewart, then the Adjutant General of Ohio, and Project Officer Lt. Colonel Robert C. Timmons, who directed the volunteer efforts of the Ohio National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF OHIO

LAKE NAME	COUNTY
Atwood	Carroll, Tuscarawas
Beach City	Stark, Tuscarawas
Berlin	Mahoning, Portage, Stark
Buckeye	Fairfield, Licking, Perry
Charles Mill	Ashland, Richland
Deer Creek	Fayette, Pickaway
Delaware	Delaware
Dillon	Muskingum
Grand Lake of St. Marys	Auglaize, Mercer
Grant	Brown
Holiday	Huron
Hoover	Delaware, Franklin
Indian	Logan
Loramie	Auglaize, Shelby
Mosquito Creek	Trumbull
O'Shaughnessy	Delaware
Pymatuning	Ashtabula, OH; Crawford, PA
Pleasant Hill	Ashland, Richland
Rocky Fork	Highland
Shawnee	Greene
Tappan	Harrison


DILLON RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Plant
Land Subject To Inundation
Scale
Ohio
Map Location
Sycamore Creek
Vance Creek
North Fork
Licking River
Hartford
Homer
Utica
Miller Co
Lake Fork
Licking River
Clear Fork
Lobdell Creek
Johnstown
Fredonia
Prescott Estates
North Fork
Licking R
Dry Creek
Raccoon Creek
Granville
NEWARK
Licking Cty Home
Forest Hills
Heath
Rocky Fork
Purity
Lost Run
Rocky Fork
Manover
Boston
LICKING RIVER
Toboso
Frazeysburg
Stump Run
Big Run
Dresden
Cottage Hill
DILLON RESERVOIR
outlet
Zanesville
Clayluck Creek
Dutch Fork
South Fork
Jardin Manor Subd
Hebron
Buckeye Lake SD
Buckeye Lake

DILLON RESERVOIR

STORET NO. 3908

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Dillon Reservoir is eutrophic. It ranked eighteenth in overall trophic quality when the 20 Ohio lakes sampled in 1973 were compared using a combination of six parameters*. Sixteen of the lakes had less median total phosphorus, 18 had less median dissolved phosphours, 13 had less median inorganic nitrogen, eight had less mean chlorophyll a, and 11 had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at sampling station 1 in July and October.

Survey limnologists noted sumberged vegetation at station 1 in October and an algal bloom along the shoreline at station 3 in April.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Dillon Reservoir was phosphorus limited at the time the sample was collected (04/26/73). The reservoir data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources amounted to about 41% of the total input to Dillon Reservoir during the sampling year. Newark contributed 21.5%;

* See Appendix A.

Heath, 4.4%; Buckeye Lake SD, 4.3%; Johnstown, 2.7%; Granville, 2.5%; Utica, 1.3%; Patalaska, 1.1%; Hebron, 1.1%; and seven other domestic sources collectively contributed 1.8%.

The present phosphorus loading of 32.91 $g/m^2/yr$ is over 15 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 15). However, Vollenweider's model may not be applicable to water bodies with short hydraulic retention times, and the mean hydraulic retention time of Dillon Reservoir is a short nine days. Nonetheless, the existing trophic condition of the reservoir is evidence of excessive nutrient loads.

While even a 100% reduction in the phosphorus loads from the known point sources would still leave a loading of 19.51 $g/m^2/yr$, the reservoir is phosphorus limited, and all phosphorus inputs should be minimized to the greatest practicable extent to slow the eutrophication of Dillon Reservoir.

2. Non-point sources--About 59% of the total phosphorus input to Dillon Reservoir during the sampling year is attributed to non-point sources. After accounting for the known point sources, the Licking River contributed 56.4% of the total. The remaining sampled tributaries collectively contributed 1.5% of the total phosphorus load. The contribution of ungaged tributaries was estimated to have been 1.3% of the total.

The phosphorus export rate of the Licking River was substantially higher than the rates of the other tributaries sampled (see page 14). It is likely that municipal point sources beyond the 40-kilometer

limit of the Survey* or industrial point sources (see page 11) contributed significantly to the phosphorus load in the river.

* See Working Paper No. 175, "...Survey Methods, 1973-1976".

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry (at normal pool level)††:

1. Surface area: 5.36 kilometers^2.
2. Mean depth: 3.0 meters.
3. Maximum depth: >7.6 meters.
4. Volume: 16.080 x 10^6 m^3.
5. Mean hydraulic retention time: 9 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Licking River	1,390.8	15.2
Big Run	14.6	0.2
Stump Run	8.9	0.1
Rocky Fork	193.7	2.0
Bowling Green Run	12.8	0.1
Claylick Creek	49.7	0.5
Brushy Fork	40.9	0.4
Minor tributaries & immediate drainage -	205.0	2.2
Totals	1,916.4	20.7

2. Outlet -

Licking River	1,921.8**	20.7

C. Precipitation***:

1. Year of sampling: 106.2 centimeters.
2. Mean annual: 100.1 centimeters.

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† Table of metric conversions--Appendix B.
†† Youger, 1975.
* For limits of accuracy, see Working Paper No. 175.
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Dillon Reservoir was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from one or more depths at two stations during the summer and from three stations during the spring and fall (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 7.6 meters at station 1, 3.0 meters at station 2, and 2.1 meters at station 3.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR DILLON RESERVOIR
STORET CODE 3908

PARAMETER	1ST SAMPLING (4/26/73) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/30/73) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/ 8/73) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	13.1 - 16.0	14.6	14.3	23.9 - 25.4	24.8	24.8	19.8 - 21.4	20.7	21.0
DISS OXY (MG/L)	4.2 - 10.9	8.5	9.0	0.7 - 8.0	4.6	4.6	1.0 - 8.6	4.2	3.4
CNDCTVY (MCROMO)	380. - 430.	404.	398.	314. - 420.	353.	340.	440. - 510.	486.	503.
PH (STAND UNITS)	7.9 - 8.4	8.1	8.0	7.4 - 8.3	7.8	7.8	7.2 - 8.5	7.7	7.6
TOT ALK (MG/L)	121. - 143.	133.	132.	99. - 134.	111.	103.	135. - 146.	142.	143.
TOT P (MG/L)	0.122 - 0.204	0.150	0.134	0.106 - 0.293	0.198	0.195	0.097 - 0.300	0.192	0.193
ORTHO P (MG/L)	0.004 - 0.061	0.032	0.032	0.031 - 0.076	0.049	0.050	0.021 - 0.093	0.041	0.034
NO2+NO3 (MG/L)	1.200 - 1.600	1.440	1.500	1.080 - 1.350	1.214	1.200	0.890 - 1.590	1.152	1.105
AMMONIA (MG/L)	0.100 - 0.390	0.226	0.240	0.090 - 0.450	0.246	0.260	0.300 - 0.940	0.653	0.700
KJEL N (MG/L)	0.900 - 1.500	1.090	1.050	1.400 - 1.800	1.560	1.500	2.200 - 3.200	2.767	2.900
INORG N (MG/L)	1.300 - 1.890	1.666	1.740	1.170 - 1.710	1.460	1.460	1.420 - 2.360	1.805	1.690
TOTAL N (MG/L)	2.200 - 2.700	2.530	2.600	2.680 - 3.000	2.774	2.750	3.130 - 4.490	3.918	4.155
CHLRPYL A (UG/L)	10.8 - 25.9	16.5	12.7	20.0 - 54.6	37.3	37.3	14.7 - 60.3	31.7	20.2
SECCHI (METERS)	0.4 - 0.5	0.4	0.4	0.3 - 0.6	0.5	0.5	0.3 - 0.7	0.5	0.6

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/26/73	1. Oscillatoria sp.	8,710
	2. Nitzschia sp.	2,393
	3. Scenedesmus sp.	100
	4. Navicula sp.	100
	5. Centric diatoms	100
	Other genera	831
	Total	12,234
07/30/73	1. Flagellates	2,755
	2. Merismopedia sp.	2,280
	3. Stephanodiscus sp.	2,185
	4. Nitzschia sp.	1,995
	5. Chroococcus sp.	1,900
	Other genera	9,022
	Total	20,137
10/08/73	1. Flagellates	11,358
	2. Oscillatoria sp.	1,045
	3. Stephanodiscus sp.	950
	4. Scenedesmus sp.	430
	5. Raphidiopsis sp.	294
	Other genera	1,444
	Total	15,521

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/26/73	01	25.9
	02	12.7
	03	10.8
07/30/73	01	20.0
	02	54.6
	03	-
10/08/73	01	14.7
	02	60.3
	03	20.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.008	0.368	11.7
0.050 P	0.058	0.368	20.2
0.050 P + 1.0 N	0.058	1.368	19.9
1.0 N	0.008	1.368	10.1

2. Filtered and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.040	1.470	13.9
0.050 P	0.090	1.470	29.0
0.050 P + 1.0 N	0.090	2.470	32.6
1.0 N	0.040	2.470	13.0

3. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Dillon Reservoir was high at the time the sample was collected (04/26/73). The addition of phosphorus alone produced a significant increase in yield in both assays which indicates limitation by phosphorus. Note that in neither assay did the addition of nitrogen alone result in a yield significantly different than that of the control.

The reservoir data also indicate phosphorus limitation. At all sampling stations and times, the mean inorganic nitrogen/orthophosphorus ratios were 23/1 or greater.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Ohio National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Ohio District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient exports, in $kg/km^2/year$, at stations B-1, C-1, E-1, and F-1 and multiplying the means by the ZZ area in km^2.

The operators of the Newark and Pataskala wastewater treatment plants provided monthly effluent samples and corresponding flow data. The operators of the Granville, Utica, Heath, Hebron, Dillon State Park #1 and #2, and the Lake and Hills Sewer District wastewater treatment plants did not participate in the sampling program, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year.

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* See Working Paper No. 175.

Nutrient loads from the wastewater treatment plants at Buckeye Lake SD#1, Forest Hills Subdivision #2, Jardin Manor Subdivision, Johnstown, Licking County Home, and the Miller Company were calculated using daily loads provided by the Ohio Environmental Protection Agency (Younger, 1975); however, nitrogen loads shown for these sources are total Kjeldahl nitrogen only.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Newark†	43,000	act. sludge	33,284.1††	Licking River
Pataskala†	2,000	aer. lagoon	1,016.2	South Fork Licking River
Granville*	3,963	trickling filter	1,500.0	Raccoon Creek
Utica*	1,977	act. sludge	748.3	North Fork Licking River
Heath*	6,768	act. sludge	2,561.7	Ramp Creek
Hebron*	1,699	ext. aer.	643.1	South Fork Licking River
Buckeye Lake SD #1**	5,470	trickling filter	2,070.4	Buckeye L. outlet stream
Prescott Estates**	400	ext. aer.	151.4	North Fork Licking River
Forest Hills Subd. #2**	600	act. sludge	227.1 (design)	Licking River
Jardin Manor Subd.**	1,000	ext. aer. + sand filter	378.5 (design)	South Fork Licking River
Johnstown**	3,490	trickling filter	1,321.0	Raccoon River
Licking Cty. Home**	50	ext. aer.	189.0 (design)	North Fork Licking River
Dillon State Park #1**	-	ext. aer.	?	Dillon Reservoir
#2**	-	ext. aer.	?	Big Run
Lake & Hills SD #9**	280	ext. aer. + sand filter	106.0	Big Run

† Treatment plant questionnaires.
†† More than 25% of waste load is from industry.
* Anonymous, 1971 (populations are 1970 census; flows estimated at 0.3785 m^3/capita/day).
** Younger, 1975; population estimated from flow (0.3785 m^3/capita/day).

2. Known Industrial* -

Name	Product	Treatment	Mean Flow (m^3/d)	Receiving Water
Miller Co.	lighting equip.	?	49.2	N. Fork Licking River

Fifteen additional industries (combined flow = 19,099.1 m^3/d) impact the North and South Forks of the Licking River. These include the Ashland Oil Company, Dayton Precision Company, Dow Chemical Company, Kaiser Alumunim (2 plants), Koppers Company, National Gypsum Company, Newark Processing, Owens-Corning Fiberglass (2 plants), Pacific Resin and Chemical, Resinoid Engineer's Corporation, Rockwell Standard, and Scoville-General Hose and Coupling. These sources are not included in the loadings on the following pages because no data are available on the amounts of nutrients they contribute, if any. However, any nutrient loads from these sources are included in the loads measured in the Licking River at station A-2.

* Youger, 1975.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Licking River	99,445	56.4
Big Run	140	0.1
Stump Run	65	<0.1
Rocky Fork	1,330	0.8
Bowling Green Run	195	0.1
Claylick Creek	680	0.4
Brushy Fork	250	0.1
b. Minor tributaries & immediate drainage (non-point load) -	2,345	1.3
c. Known municipal STP's -		
Newark	37,930	21.5
Pataskala	1,940	1.1
Granville	4,495	2.5
Utica	2,240	1.3
Heath	7,675	4.4
Hebron	1,925	1.1
Buckeye Lake, SD #1	7,555	4.3
Prescott Estates	550	0.3
Forest Hills Subd. #2	840	0.5
Jardin Manor Subd.	1,385	0.8
Johnstown	4,820	2.7
Licking Cty. Home	75	<0.1
Dillon St. Park #1*	10	<0.1
Dillon St. Park #2*	10	<0.1
Lake & Hills SD #9	320	0.2
d. Septic tanks** -	30	<0.1
e. Known industrial -		
Miller Co.	75	<0.1
f. Direct precipitation*** -	95	<0.1
Total	176,420	100.0

2. Outputs -

Lake outlet - Licking River 86,675

3. Net annual P accumulation - 89,745 kg.

* Estimated; see Working Paper No. 175.
** Estimate based on 103 lakeshore dwellings; see Working Paper No. 175.
*** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Licking River	1,424,020	56.7
Big Run	6,925	0.3
Stump Run	3,785	0.2
Rocky Fork	96,545	3.8
Bowling Green Run	6,835	0.3
Claylick Creek	28,640	1.1
Brushy Fork	11,155	0.4
b. Minor tributaries & immediate drainage (non-point load) -	103,015	4.1
c. Known municipal STP's -		
Newark	726,925	28.9
Pataskala	2,805	0.1
Granville	13,480	0.5
Utica	6,725	0.3
Heath	23,020	0.9
Hebron	5,780†	0.2
Buckeye Lake SD #1	18,870†	0.8
Prescott Estates	110†	<0.1
Forest Hills Subd. #2	2,080†	0.1
Jardin Manor Subd.	290†	<0.1
Johnstown	12,045†	0.5
Licking Cty. Home	12,045†	0.5
Dillon St. Park #1*	30	<0.1
Dillon St. Park #2*	30	<0.1
Lake & Hills SD #9	950	<0.1
d. Septic tanks** -	1,100	<0.1
e. Known industrial -		
Miller Co.	?	?
f. Direct precipitation*** -	5,785	0.2
Total	2,512,990	100.0

† Based on total Kjeldahl nitrogen.
* Estimated; see Working Paper No. 175.
** Estimate based on 103 lakeshore dwellings; see Working Paper No. 175.
*** See Working Paper No. 175.

Source	kg N/ yr
2. Outputs -	
Lake outlet - Licking River	1,963,950

3. Net annual N accumulation - 549,040 kg.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Licking River	72	1,024
Big Run	10	474
Stump Run	7	425
Rocky Fork	7	498
Bowling Green Run	15	534
Claylick Creek	14	576
Brushy Fork	6	273

E. Yearly Loading Rates:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	32.91	16.74	468.8	102.4

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Dillon Reservoir:

"Dangerous" (eutrophic loading)	2.10
"Permissible" (oligotrophic loading)	1.05

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3901	BEACH CITY RESERVOIR	0.122	1.490	489.000	10.867	11.600	0.015
3902	BUCKEYE LAKE	0.179	0.380	490.000	186.567	9.600	0.020
3905	CHARLES MILL RESERVOIR	0.127	0.465	482.555	67.144	15.000	0.011
3906	DEER CREEK RESERVOIR	0.098	2.980	470.125	9.887	13.900	0.036
3907	DELAWARE RESERVOIR	0.086	2.340	484.111	10.856	14.500	0.024
3908	DILLION RESERVOIR	0.163	1.590	481.250	27.400	14.300	0.037
3912	GRANT LAKE	0.113	0.570	486.333	40.533	12.200	0.019
3914	HOOVER RESERVOIR	0.040	1.640	462.750	13.017	14.800	0.008
3915	INDIAN LAKE	0.120	0.380	485.222	76.855	14.200	0.012
3917	LORAMIE LAKE	0.185	1.380	494.000	104.100	8.200	0.019
3921	MOSQUITO CREEK RESERVOIR	0.058	0.150	465.333	36.267	11.600	0.006
3924	PLEASANT HILL LAKE	0.036	0.455	456.833	22.850	14.700	0.010
3927	LAKE SAINT MARYS	0.148	0.200	484.167	79.150	8.200	0.014
3928	ATWOOD RESERVOIR	0.031	0.205	462.000	16.442	14.700	0.005
3929	BERLIN RESERVOIR	0.042	0.900	465.435	15.496	13.600	0.006
3930	HOLIDAY LAKE	0.125	0.575	465.333	55.350	15.000	0.034
3931	O'SHAUGNESSY RESERVOIR	0.208	3.070	479.333	5.522	14.900	0.159
3932	ROCKY FORK LAKE	0.067	0.790	473.000	38.022	15.000	0.010
3933	SHAWNEE LAKE	0.069	2.380	474.333	39.567	15.000	0.009
3934	TAPPAN LAKE	0.040	0.280	466.111	37.711	15.000	0.007

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3901	BEACH CITY RESERVOIR	37 (7)	21 (4)	11 (2)	84 (16)	82 (15)	42 (8)	277
3902	BUCKEYE LAKE	11 (2)	76 (14)	5 (1)	0 (0)	89 (17)	26 (5)	207
3905	CHARLES MILL RESERVOIR	26 (5)	63 (12)	37 (7)	21 (4)	11 (0)	58 (11)	216
3906	DEER CREEK RESERVOIR	53 (10)	5 (1)	63 (12)	95 (18)	63 (12)	11 (2)	290
3907	DELAWARE RESERVOIR	58 (11)	16 (3)	32 (6)	89 (17)	47 (9)	21 (4)	263
3908	DILLION RESERVOIR	16 (3)	32 (6)	42 (8)	58 (11)	53 (10)	5 (1)	206
3912	GRANT LAKE	47 (9)	58 (11)	16 (3)	32 (6)	74 (14)	34 (6)	261
3914	HOOVER RESERVOIR	87 (16)	26 (5)	89 (17)	79 (15)	32 (6)	79 (15)	392
3915	INDIAN LAKE	42 (8)	76 (14)	21 (4)	16 (3)	58 (11)	53 (10)	266
3917	LORAMIE LAKE	5 (1)	37 (7)	0 (0)	5 (1)	97 (18)	34 (6)	178
3921	MOSQUITO CREEK RESERVOIR	74 (14)	100 (19)	82 (15)	53 (10)	82 (15)	92 (17)	483
3924	PLEASANT HILL LAKE	95 (18)	68 (13)	100 (19)	63 (12)	39 (7)	66 (12)	431
3927	LAKE SAINT MARYS	21 (4)	95 (18)	26 (5)	11 (2)	97 (18)	47 (9)	297
3928	ATWOOD RESERVOIR	100 (19)	89 (17)	95 (18)	68 (13)	39 (7)	100 (19)	491
3929	BERLIN RESERVOIR	79 (15)	42 (8)	74 (14)	74 (14)	68 (13)	92 (17)	429
3930	HOLIDAY LAKE	32 (6)	53 (10)	82 (15)	26 (5)	11 (0)	16 (3)	220
3931	O'SHAUGNESSY RESERVOIR	0 (0)	0 (0)	47 (9)	100 (19)	26 (5)	0 (0)	173
3932	ROCKY FORK LAKE	68 (13)	47 (9)	58 (11)	42 (8)	11 (0)	66 (12)	292
3933	SHAWNEE LAKE	63 (12)	11 (2)	53 (10)	37 (7)	11 (0)	74 (14)	249
3934	TAPPAN LAKE	87 (16)	84 (16)	68 (13)	47 (9)	11 (0)	84 (16)	381

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3928	ATWOOD RESERVOIR	491
2	3921	MOSQUITO CREEK RESERVOIR	483
3	3924	PLEASANT HILL LAKE	431
4	3929	BERLIN RESERVOIR	429
5	3914	HOOVER RESERVOIR	392
6	3934	TAPPAN LAKE	381
7	3927	LAKE SAINT MARYS	297
8	3932	ROCKY FORK LAKE	292
9	3906	DEER CREEK RESERVOIR	290
10	3901	BEACH CITY RESERVOIR	277
11	3915	INDIAN LAKE	266
12	3907	DELAWARE RESERVOIR	263
13	3912	GRANT LAKE	261
14	3933	SHAWNEE LAKE	249
15	3930	HOLIDAY LAKE	220
16	3905	CHARLES MILL RESERVOIR	216
17	3902	BUCKEYE LAKE	207
18	3908	DILLION RESERVOIR	206
19	3917	LORAMIE LAKE	178
20	3931	O'SHAUGNESSY RESERVOIR	173

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR OHIO 1/27/75

LAKE CODE 3908 DILLON RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1921.8

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3908A1	1921.8	32.85	38.23	48.99	38.79	22.29	16.08	10.76	5.95	3.79	4.19	9.12	18.38	20.68
3908A2	1390.8	23.64	27.67	36.25	28.32	16.25	12.46	8.55	4.36	2.66	3.14	6.54	13.17	15.18
3908B1	14.6	0.24	0.34	0.37	0.31	0.17	0.09	0.06	0.04	0.03	0.02	0.06	0.14	0.16
3908C1	8.9	0.15	0.19	0.23	0.19	0.11	0.06	0.04	0.02	0.02	0.01	0.04	0.08	0.09
3908D1	193.7	3.34	3.82	4.59	3.74	2.18	1.33	0.82	0.59	0.42	0.40	0.96	1.93	2.00
3908E1	12.8	0.22	0.27	0.34	0.27	0.15	0.08	0.05	0.03	0.02	0.02	0.06	0.12	0.14
3908F1	49.7	0.85	1.02	1.25	0.99	0.57	0.34	0.20	0.14	0.10	0.09	0.23	0.48	0.52
3908G1	40.9	0.68	0.85	1.02	0.82	0.48	0.27	0.17	0.12	0.08	0.07	0.19	0.40	0.43
3908Z2	210.3	3.62	4.19	4.98	4.02	2.38	1.44	0.88	0.62	0.45	0.42	1.05	2.07	2.17

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1921.8
SUM OF SUB-DRAINAGE AREAS = 1921.9
TOTAL FLOW IN = 249.33
TOTAL FLOW OUT = 249.41

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3908A1	5	73	21.15	5	26.96				
	6	73	39.36	3	11.55				
	7	73	23.45	8	9.12				
	8	73	8.86	12	4.56				
	9	73	3.51	16	3.37				
	10	73	8.33	14	3.96				
	11	73	27.01	11	8.18				
	12	73	70.51	9	122.05				
	1	74	54.37	13	18.07				
	2	74	35.96	9	71.36	23	52.95		
	3	74	31.15	9	24.27	23	39.08		
	4	74	63.71	20	30.87				
3908A2	5	73	14.78	5	20.08				
	6	73	30.30	3	9.20				
	7	73	20.08	8	6.85				
	8	73	6.80	12	4.33				
	9	73	2.94	16	2.63				
	10	73	6.68	14	3.11				
	11	73	41.34	11	6.74				
	12	73	34.55	9	27.55				
	1	74	41.63	13	12.32				
	2	74	25.32	9	27.61	23	39.64		
	3	74	28.54	9	18.01	23	20.87		
	4	74	37.38	20	11.86				

TRIBUTARY FLOW INFORMATION FOR OHIO 1/27/75

LAKE CODE 3908 DILLON RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3908B1	5	73	0.17	5	0.21				
	6	73	0.24	3	0.12				
	7	73	0.10	8	0.07				
	8	73	0.06	12	0.04				
	9	73	0.02	16	0.00				
	10	73	0.03	14	0.05				
	11	73	0.27	11	0.06				
	12	73	0.25	9	0.25				
	1	74	0.37	13	0.21				
	2	74	0.25	9	0.40	23	0.48		
	3	74	0.34	9	0.26	23	0.34		
	4	74	0.57	20	0.13				
3908C1	5	73	0.10	5	0.13				
	6	73	0.15	3	0.08				
	7	73	0.06	8	0.05				
	8	73	0.03	12	0.03				
	9	73	0.01	16	0.01				
	10	73	0.02	14	0.03				
	11	73	0.16	11	0.04				
	12	73	0.15	9	0.15				
	1	74	0.22	13	0.13				
	2	74	0.14	9	0.24	23	0.31		
	3	74	0.21	9	0.16	23	0.20		
	4	74	0.34	20	0.08				
3908D1	5	73	2.15	5	2.78				
	6	73	3.43	3	1.64				
	7	73	1.39	8	0.96				
	8	73	0.85	12	0.54				
	9	73	0.31	16	0.28				
	10	73	0.57	14	0.65				
	11	73	4.25	11	0.76				
	12	73	3.34	9	3.26				
	1	74	5.10	13	2.75				
	2	74	2.80	9	5.27	23	6.57		
	3	74	4.16	9	3.45	23	4.39		
	4	74	6.88	20	1.70				
3908E1	5	73	0.15	5	0.18				
	6	73	0.21	3	0.11				
	7	73	0.08	8	0.07				
	8	73	0.05	12	0.04				
	9	73	0.02	16	0.02				
	10	73	0.03	14	0.05				
	11	73	0.25	11	0.05				
	12	73	0.22	9	0.22				
	1	74	0.34	13	0.18				
	2	74	0.20	9	0.34	23	0.42		
	3	74	0.31	9	0.23	23	0.28		
	4	74	0.51	20	0.11				

TRIBUTARY FLOW INFORMATION FOR OHIO 1/27/75

LAKE CODE 3908 DILLON RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3908F1	5	73	0.57	5	0.71				
	6	73	0.88	3	0.42				
	7	73	0.34	8	0.25				
	8	73	0.20	12	0.14				
	9	73	0.07	16	0.03				
	10	73	0.12	14	0.17				
	11	73	1.02	11	0.20				
	12	73	0.82	9	0.85				
	1	74	1.30	13	0.71				
	2	74	0.74	9	1.36	23	1.70		
	3	74	1.13	9	0.88	23	1.13		
	4	74	1.81	20	0.42				
3908G1	5	73	0.48	5	0.59				
	6	73	0.68	3	0.34				
	7	73	0.28	8	0.20				
	8	73	0.17	12	0.11				
	9	73	0.06	16	0.01				
	10	73	0.10	14	0.14				
	11	73	0.82	11	0.16				
	12	73	0.68	9	0.68				
	1	74	1.05	13	0.57				
	2	74	0.62	9	1.10	23	1.39		
	3	74	0.93	9	0.74	23	0.93		
	4	74	1.50	20	0.37				
3908Z2	5	73	2.35						
	6	73	3.71						
	7	73	1.47						
	8	73	0.88						
	9	73	0.34						
	10	73	0.57						
	11	73	4.62						
	12	73	3.60						
	1	74	5.52						
	2	74	3.06						
	3	74	4.50						
	4	74	7.42						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

390601
39 59 38.0 082 05 02.0
DILLION RESERVOIR
39119 OHIO

11EPALES 2111202
3 0030 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/26	13 35	0000	16.0		20	380	8.40	136	0.100	1.200	1.300	0.008
	13 35	0005	16.0	9.2		390	8.30	138	0.100	1.000	1.200	0.004
	13 35	0015	15.7	8.1		400	8.10	121	0.100	1.000	1.300	0.006
	13 35	0025	14.6	4.2		390	7.90	121	0.390	1.500	1.200	0.020
73/07/30	13 25	0000	25.4	4.6	24	340	8.10	102	0.090	1.600	1.080	0.031
	13 25	0005	25.0			340						
	13 25	0010	24.8			340						
	13 25	0015	24.6	3.1		335	7.50	103	0.330	1.500	1.180	0.051
	13 25	0020	23.9	0.7		314	7.40	99	0.450	1.500	1.260	0.038
73/10/08	13 40	0000	21.2		26	510	7.90	140	0.510	2.200	0.930	0.021
	13 40	0005	21.1	3.4		510	7.50	146	0.630	2.300	0.890	0.024
	13 40	0015	20.9	2.8		500	7.40	145	0.770	2.900	1.090	0.037
	13 40	0025	20.1	1.0		440	7.20	135	0.940	3.100	1.290	0.041

-82-

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/26	13 35	0000	0.122	25.9
	13 35	0005	0.122	
	13 35	0015	0.128	
	13 35	0025	0.204	
73/07/30	13 25	0000	0.106	20.0
	13 25	0015	0.163	
	13 25	0020	0.232	
73/10/08	13 40	0000	0.097	14.7
	13 40	0005	0.102	
	13 40	0015	0.149	
	13 40	0025	0.269	

STORET RETRIEVAL DATE 75/01/27

390802
40 01 08.0 082 07 24.0
DILLON RESERVOIR
39119 OHIO

11EPALES
3

2111202
0013 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/26	14 00	0000	14.1		16	390	8.00	128	0.240	1.100	1.600	0.034
	14 00	0003	14.0	10.9		400	8.00	128	0.240	1.100	1.500	0.038
	14 00	0010	14.0	8.8		395	8.00	128	0.240	1.100	1.500	0.031
73/07/30	14 00	0000	25.4	6.0	12	385	8.30	119	0.100	1.400	1.350	0.050
	14 00	0006	24.2	6.4		420	7.80	134	0.260	1.800	1.200	0.076
73/10/08	14 05	0000	21.4	8.6	24	505	8.50	143	0.300	3.200	1.120	0.031

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/26	14 00	0000	0.177	12.7
	14 00	0003	0.172	
	14 00	0010	0.176	
73/07/30	14 00	0000	0.195	54.6
	14 00	0006	0.293	
73/10/08	14 05	0000	0.238	60.3

STORET RETRIEVAL DATE 75/01/27

390803
40 02 24.0 082 08 23.0
DILLON RESERVOIR
39119 OHIO

11EPALES 2111202
3 0009 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/26	14 35	0000	14.9		16	430	8.00	142	0.290	1.000	1.600	0.061
	14 35	0004	13.4	9.2		430	8.00	143	0.280	1.000	1.600	0.058
	14 35	0007	13.1	9.0		430	8.00	142	0.280	0.900	1.600	0.056
73/10/08	14 20	0000	19.8	5.2	12	452	7.70	142	0.770	2.900	1.590	0.093

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/26	14 35	0000	0.135	10.8
	14 35	0004	0.133	
	14 35	0007	0.132	
73/10/08	14 20	0000	0.300	20.2

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/02/03

3908A1
39 59 29.0 082 04 55.0
LICKING RIVER
39041 7.5 ZANESVILLE W
O/DILLON RESERVOIR
AT DAM SPILLWAY
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	13 35		1.420	1.150	0.210	0.050	0.100
73/06/03	09 40		0.960	1.800	0.415	0.057	0.130
73/07/08	09 05		1.800	2.940	0.470	0.036	0.115
73/08/12	10 01		0.540	1.470	0.570	0.039	0.170
73/09/16	09 40		0.570	2.800	1.200	0.030	0.130
73/10/14	08 50		1.260	2.200	0.480	0.034	0.130
73/11/11	10 10		2.240	1.500	0.384	0.052	0.135
73/12/09	09 45		1.510	0.700	0.100	0.040	0.130
74/01/13	09 10		1.680	1.500	0.600	0.132	0.180
74/02/09	09 00		1.400	1.000	0.330	0.070	0.155
74/02/23	10 05		1.700	1.300	0.340	0.040	0.150
74/03/09	10 30		1.440	1.100	0.240	0.040	0.160
74/03/23	12 10		1.510	1.200	0.340	0.040	0.120
74/04/20	09 30		1.340	1.300	0.195	0.030	0.045

STORET RETRIEVAL DATE 75/02/03

3908A2
40 03 30.0 082 20 17.0
LICKING RIVER
39 7.5 HANOVER
I/DILLON RESERVOIR
HWY BRDG BTWN MARNE AND NEWARK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	16	15	1.100	3.000	0.410	0.021	0.160
73/06/03	10	30	1.720	3.500	1.000	0.147	0.220
73/07/08	10	55	2.020	3.300	1.260	0.190	0.300
73/08/12	12	15	0.840	3.800	2.200	0.620	0.750
73/09/16	11	35	1.060	9.900	6.700	0.336	0.580
73/10/14	10	45	0.900	8.100	3.200	0.336	0.590
73/11/11	12	30	0.920	2.900	1.140	0.352	0.490
73/12/09	12	15	1.400	1.200	0.356	0.118	0.230
74/01/13	11	40	1.600	2.350	1.160	0.124	0.195
74/02/09	12	30	1.900	1.100	0.440	0.075	0.120
74/02/23	13	55	2.000	1.300	0.220	0.035	0.150
74/03/09	14	00	1.200	1.800	0.490	0.035	0.135
74/03/23	12	04	1.440	1.700	0.710	0.790	0.890
74/04/20	13	50	1.040	2.000	1.000	0.107	0.130

STORET RETRIEVAL DATE 75/02/03

390881
40 05 33.0 082 03 44.0
BIG RUN
39 7.5 DRESDEN
T/DILLON RESERVOIR
RT 77 BRDG 3 MI SW OF DRESDEN
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	14	28	0.330	0.910	0.050	0.005K	0.012
73/06/03	10	20	0.260	1.600	0.130	0.012	0.020
73/07/08	09	45	0.270	2.600	0.105	0.016	0.030
73/08/12	10	30	0.140	1.800	0.048	0.024	0.030
73/09/16	10	10	0.056	1.260	0.357	0.010	0.080
73/10/14	09	25	0.029	1.100	0.063	0.010	0.030
73/11/11	10	40	0.208	0.150	0.036	0.020	0.035
73/12/09	10	15	0.570	0.100K	0.032	0.008	0.015
74/02/09	09	40	0.980	0.100	0.040	0.010	0.015
74/02/23	10	40	0.820	0.200	0.030	0.010	0.025
74/03/09	10	45	0.420	0.200	0.025	0.005	0.035
74/03/23	11	10	0.660	0.200	0.025	0.005	0.010
74/04/20	11	00	0.300	2.100	0.025	0.005	

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

3908C1
40 03 58.0 082 07 06.0
STUMP RUN
39 7.5 DRESDEN
T/DILLON RESERVOIR
UNIMPROVED RD BRDG 3 MI S OF FRAZEYBURG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	15 00		0.357	1.050	0.069	0.005K	0.010
73/06/03	10 30		0.115	1.320	0.130	0.008	0.020
73/07/08	09 57		0.092	3.100	0.147	0.010	0.030
73/08/12	10 40		0.070	0.460	0.105	0.011	0.030
73/09/16	10 30		0.022	0.920	0.110	0.006	0.035
73/10/14	09 40		0.025	1.500	0.072	0.012	0.050
73/11/11	11 05		0.148	0.100K	0.048	0.012	0.030
73/12/09	10 45		0.560	0.400	0.036	0.005K	0.010
74/01/13	09 45		0.680	0.100K	0.040	0.012	0.012
74/02/09	10 30		0.850	0.100	0.035	0.005	0.005
74/02/23	11 20		0.800	0.200	0.020	0.005	0.025
74/03/09	11 15		0.320	0.200	0.020	0.005K	0.040
74/03/23	11 26		0.528	2.600	0.070	0.010	0.010
74/04/20	10 15		0.260	0.200	0.040	0.005	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

3908D1
40 05 25.0 082 16 20.0
ROCKY FORK
39 7.5 HANOVER
T/DILLON RESERVOIR
2NDRY RD BRDG .75 MI N OF HANOVER
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	15	40	1.000	1.540	0.086	0.005K	0.010
73/06/03	11	40	0.560	2.730	0.090	0.008	0.025
73/07/08	10	25	0.420	1.260	0.039	0.008	0.020
73/08/12	11	20	0.410	0.500	0.050	0.011	0.020
73/09/16	11	00	0.450	0.230	0.026	0.007	0.025
73/10/14	10	10	0.357	1.100	0.040	0.022	0.022
73/11/11	11	45	0.670	0.100K	0.012	0.012	0.015
73/12/09	11	00	1.430	0.100K	0.020	0.008	0.017
74/01/13	10	15	1.260	0.200	0.016	0.012	0.015
74/02/09	11	00	1.430	0.100	0.015	0.005	0.010
74/02/23	12	00	1.440	0.300	0.015	0.010	0.045
74/03/09	12	15	1.000	0.200	0.015	0.005K	0.040
74/03/23	13	30	1.100	0.100	0.020	0.005	
74/04/20	12	20	0.820	0.100	0.025	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

3908E1
40 04 20.0 082 18 50.0
BOWLING GREEN RUN
39 7.5 HANOVER
T/DILLON RESERVOIR
UNIMPROVED RD BRDG W EDGE OF MARNE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	16 05		0.700	0.840	0.034	0.011	0.040
73/06/03	11 45		0.630	1.390	0.088	0.013	0.030
73/07/08	10 47		0.710	1.890	0.078	0.017	0.055
73/08/12	12 00		0.510	1.000	0.052	0.028	0.090
73/09/16	11 45		0.460	1.260	0.430	0.056	0.125
73/10/14	10 20		0.430	1.900	0.180	0.025	0.060
73/11/11	12 15		0.760	0.300	0.100	0.014	0.026
73/12/09	11 30		1.200	0.200	0.024	0.008	0.020
74/01/13	10 50		1.260	0.200	0.028	0.016	0.025
74/02/09	11 30		1.260	0.100	0.020	0.010	0.015
74/02/23	13 15		1.100	0.300	0.010	0.010	0.045
74/03/09	13 00		0.690	0.300	0.010	0.005	0.055
74/03/23	11 20		0.720	0.300	0.015	0.010	0.035
74/04/20	13 00		0.640	0.300	0.020	0.005	0.017

STORET RETRIEVAL DATE 75/02/03

3908F1
40 03 05.0 082 18 05.0
CLAYLICK CREEK
39 7.5 HANOVER
T/DILLON RESERVOIR
2NDRY RD BRDG 1 MI SW OF CLAYLICK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	16 30		0.860	1.300	0.037	0.006	0.015
73/06/03	12 55		0.660	0.720	0.042	0.009	0.030
73/07/08	11 10		1.200	2.310	0.072	0.018	0.055
73/08/12	12 20		0.860	1.800	0.083	0.009	0.020
73/09/16	13 10		0.750	0.920	0.058	0.012	0.095
73/10/14	11 00		0.410	0.637	0.037	0.022	0.050
73/11/11	12 50		0.890	0.100K	0.020	0.020	0.025
73/12/09	14 00		1.520	1.100	0.096	0.040	0.135
74/01/13	12 20		1.260	0.200	0.008	0.005	0.020
74/02/09	13 20		1.300	0.200	0.020	0.005	0.015
74/02/23	14 30		1.120	0.400	0.010	0.005	0.035
74/03/09	14 30		0.720	0.200	0.010	0.005K	0.045
74/03/23	12 00		0.780	0.500	0.015	0.005	0.025
74/04/20	14 30		0.750	0.150	0.020	0.005	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

3908G1
40 02 16.0 082 15 02.0
BRUSHY FORK
39 7.5 HANOVER
T/DILLON RESERVOIR
COVERED BRDG 2.5 MI SE OF CLAYLICK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/05	16	40	0.260	0.800	0.037	0.005K	0.010
73/06/03	13	40	0.140	1.200	0.058	0.008	0.020
73/07/08	11	20	0.168	1.590	0.084	0.008	0.020
73/08/12	11	40	0.093	0.150	0.034	0.006	0.015
73/09/16	13	40	0.046	0.880	0.058	0.005K	0.030
73/10/14	12	30	0.012	0.550	0.022	0.012	0.015
73/11/11	13	15	0.184	0.200	0.028	0.008	0.025
73/12/09	12	00	0.450	0.300	0.028	0.008	0.015
74/02/09	14	00	0.616	0.100K	0.020	0.005K	0.005
74/02/23	14	55	0.490	0.200	0.015	0.005K	0.025
74/03/09	15	00	0.252	0.100K	0.015	0.005K	0.040
74/03/23	11	55	0.338	0.200	0.015	0.005K	0.010
74/04/20	15	15	0.900	0.100	0.022	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/10

3908AA AS3908AA P0430008
40 03 25.0 082 21 42.0
NEWARK
39 7.5 HANOVER
T/DILLON RESERVOIR
LICKING RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/09/04	08 00								
CP(T)-			0.094	53.000	20.400	0.378		8.900	9.000
73/09/05	08 00								
73/10/01	08 00								
CP(T)-			0.080	174.000	27.000	1.680	4.500	9.500	9.000
73/10/02	08 00								
73/11/05	08 00								
CP(T)-			0.330	4.800	1.200	3.600	4.500	8.000	8.500
73/11/06	06 00								
73/12/04	08 00								
CP(T)-			0.140	41.000	14.000	1.050	2.200	9.900	8.700
73/12/05	06 00								
74/01/01	08 00								
CP(T)-			0.280	46.000	20.000	3.800	5.400	7.500	8.950
74/01/02	06 00								
74/02/28	24 00								
CP(T)-			0.280	46.000	14.000	4.600	6.000	9.200	9.150
74/03/01	22 00								
74/04/01	08 00								
CP(T)-			0.920	43.000	21.000	0.720	2.600	9.260	8.900
74/04/02	06 00								
74/05/07	08 00								
CP(T)-			0.160	47.000	23.000	2.700	3.500	8.640	8.880
74/05/08	06 00								
74/06/06	08 00								
CP(T)-			0.360	50.000	22.000	0.600	1.950	9.720	9.100
74/06/07	06 00								
74/07/02	08 00								
CP(T)-			0.200	53.000	29.000	0.630	1.550	8.230	8.740
74/07/03	06 00								
74/08/01	08 00								
CP(T)-			0.120	88.000	49.500	0.250	0.790	6.750	8.230
74/08/02	06 00								
74/09/04	08 00								
CP(T)-			0.240	62.000	41.000	0.510	1.250	9.080	8.570
74/09/05	06 00								

STORET RETRIEVAL DATE 75/02/03

3908AA AS3908AA P043000*
40 03 25.0 082 21 42.0
NEWARK
39041 7.5 HANOVER
T/DILLON RESERVOIR
LICKING RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/09/04 CP(T)- 74/09/05	08 00 06 00		0.240	62.000	41.000	0.510	1.250	9.080	8.570

-15-

STORET RETRIEVAL DATE 75/02/03

3908XA AP3908XA P002000
39 59 56.0 082 40 23.0
PATASKALA
39 7.5 PATASKALA
T/DILLON RESERVOIR
SOUTH FORK / LICKING RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/10/09	10	15	0.920	2.600	0.014	3.200	3.400	0.192	0.220
73/11/14	14	30	0.860	4.900	0.110	3.500	4.300	0.220	0.252
73/12/18	12	35	1.440	9.300	0.011	4.000	5.000	0.254	0.320
74/01/11	10	05	1.260	7.400	0.150	4.700	5.400	0.198	0.200
74/02/15	13	50	1.120	8.200	0.200	4.600	5.800	0.342	0.350
74/03/13	14	45	0.040	6.200	0.050K		7.000	0.320	0.352
74/04/23	12	55	0.760	8.300	0.110	5.900	7.200	0.304	0.436
74/05/15	14	15	0.880	12.000	0.880	4.000	7.600	0.249	0.250
74/06/20	08	20	1.140	6.300	0.065	4.550	5.400	0.226	0.228
74/07/17	08	25	0.480	1.400	0.057	3.700	3.800	0.191	0.221
74/08/27	12	25	0.040	4.300	0.050K		3.100	0.218	0.210
74/09/16	08	15	0.020	5.500	0.063	2.500	3.550	0.220	0.253
74/10/14	09	00	0.043	10.000	0.050K	2.200	3.400	0.173	0.198

K VALUE KNOWN TO BE
LESS THAN INDICATED